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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/589,419	08/15/2006	Jonathan Young	060-03US1	7252

53590 7590 09/22/2008

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EXAMINER	
VAUGHAN, MICHAEL R	

ART UNIT	PAPER NUMBER
2131	

MAIL DATE	DELIVERY MODE
09/22/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/589,419	Applicant(s) YOUNG ET AL.	
	Examiner MICHAEL R. VAUGHAN	Art Unit 2131	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 August 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 August 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9-18-06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The instant application having Application No. 10/589419 filed on 8/15/06 is presented for examination by the examiner.

Claim Objections

Claims 2, 14, and 16 are objected to because of the following informalities: claims use the term “and/or” which creates a problem in determining the scope of the claim.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:
Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 5, 6, and 11 are rejected under 35 U.S.C. 101 as directed to non-statutory subject matter of software, per se. The claim lacks the necessary physical articles or objects to constitute a machine or manufacture within the meaning of 35 U.S.C. 101. It is clearly not a series of steps or acts to be a process nor is it a combination of chemical compounds to be a composition of matter. As such, they fail to fall within a statutory category. It is at best, function descriptive material per se. The language of the claim

fail to declare that the "computer-readable medium causing a computer to execute instructions" terminology that the courts have insisted upon.

Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." Both types of "descriptive material" are non-statutory when claimed as descriptive material per se, 33 F.3d at 1360, 31 USPQ2d at 1759. When functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994).

Merely claiming non-functional descriptive material, i.e., abstract ideas, stored on a computer-readable medium, in a computer, or on an electromagnetic carrier signal, does not make it statutory. See Diehr, 450 U.S. at 185-86, 209 USPQ at 8 (noting that the claims for an algorithm in Benson were unpatentable as abstract ideas because "[t]he sole practical application of the algorithm was in connection with the programming of a general purpose computer.").See MPEP 2106.01 [R-6].

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir.

1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1, 5, and 7 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 6, and 7 of copending Application No.10/578,155. Although the conflicting claims are not identical, they are not patentably distinct from each other because the method of calibrating a quantum key distribution system is common to both applications.

Instant Application **10/589419**	Co-pending Application **10/578,155**
Claim 1 A method of **auto-calibrating a quantum key distribution** (QKD) system having two encoding stations, a laser and a **single-photon detector** (SPD) unit, comprising: a) performing a laser gate scan by sending a laser gating **signal to the laser and varying an arrival time T of the laser gating signal over a first select range R1 to determine an optimal arrival time TMAX that corresponds to an a first optimum number of photon counts** from	Claim 1 A method of **auto-calibrating a single-photon detector** arranged to detect weak photon pulses in a **quantum key distribution (QKD) system**, comprising: a) performing a detector gate scan by sending a detector gate **pulse to the single-photon detector and varying an arrival time T of the detector gating pulse over a first select range R1 to determine an optimal arrival time TMAX that corresponds to a maximum**

the SPD unit for photon signals generated by the laser and exchanged between the two encoding stations; and b) performing laser gate **dithering by varying the arrival time T over a second select range R2 surrounding TMAX to maintain either the first optimum number** of photon counts or a second optimum number of photon counts count as optimum.	**number of photon counts** NMAX from the single-photon detector; and b) performing detector gate **dithering by varying the arrival time T over a second select range R2 surrounding TMAX to maintain the photon count at a maximum value.**

As highlighted above both claims are directed to the auto-calibration of a QKD system. The main difference is the wording. The instant application sending a signal and the co-pending application uses the word pulse. A signal and pulse are obviously synonymous in the context of the invention. Both claims perform the two parts analysis of photon counts over a R1 and R2 range to achieve a maximum value. Thus there is no patentable difference between the two claims. Similarly claims 5 and 7 are share these same commons features.

This is a <u>provisional</u> obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 7-10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As per claim 7, essential method steps are omitted. The claim is directed to a method of exchanging keys. However there are no steps involving the exchange of keys. The claim is directed to auto-calibrating a QKD system but none of the limitations involve a key of any kind. The dependent claims do not rectify this problem. Appropriate correction is required.

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-16 are rejected under 35 U.S.C. 102(b) as being anticipated by “An Autocompensating Fiber-Optic Quantum Cryptography System Based on Polarization Splitting of Light" by Bethune and Risk, hereinafter Bethune.

As per claims 1, and 5, Bethune teaches a method of auto-calibrating a quantum key distribution (QKD) system having two encoding stations, a laser and a single-photon

detector (SPD) unit (Fig.1), comprising:

a) performing a laser gate scan by sending a laser gating signal to the laser and varying an arrival time T [bias pulse delay] of the laser gating signal over a first select range R1 to determine an optimal arrival time TMAX that corresponds to an a first optimum number of photon counts from the SPD unit for photon signals generated by the laser and exchanged between the two encoding stations (Fig. 3a); and

b) performing laser gate dithering by varying the arrival time T over a second select range R2 [different range by adjusting the phase] surrounding TMAX to maintain either the first optimum number of photon counts or a second optimum number of photon counts count as optimum (Fig. 3a and pg. 343).

As per claims 2 and 6, Bethune teaches the first and/or second optimum number of photon counts is/are count is either:

i) a maximum number of detected photons NMAX (Fig. 3a), or

ii) a maximum of the total number of photon counts N detected over a time interval divided by a number of double-clicks [dark counts] from the SPD unit over the time interval (Fig. 3b and pg. 343-344).

As per claim 3, Bethune teaches terminating the laser gate dithering and performing another laser gate scan [test ran multiple times] (Fig. 3a).

As per claim 4, Bethune teaches the QKD system includes a programmable controller and a computer readable medium, wherein the laser gating signal is provided by the controller, and wherein the method is embodied in the computer readable

medium such that the controller is capable of directing the QKD system to carry out acts a) and b) [computers in Fig. 1).

As per claim 7, Bethune teaches a method of exchanging a key in a quantum key distribution (QKD) system having a laser and an SPD unit both operably coupled to a controller, comprising:

exchanging photon signals between encoding stations in the QKD system, where the photon signals are generated by the laser (pg. 340);

performing a first laser gate scan by sending laser gating signals from the controller to the laser over a range R1 of laser gating signal arrival times T (Fig. 3a);

establishing from the first laser gate scan a first optimal arrival time TMAX for the laser gating signal corresponding to a first maximum number of photon counts NMAX from the detector SPD unit (pg. 343);

terminating the first laser gate scan when the first TMAX is established [multiple tests on different delays]; and

performing a first laser gate dither by the controller altering the arrival time T over a range of arrival times R2 [different phases] about the first TMAX to maintain either the first maximum number of photon counts NMAX or a different maximum number of photon counts N'MAX over the range R2 (pg. 343).

As per claim Bethune teaches performing the first laser gate dither results in a new optimal arrival time T'MAX [keeps the signal count rate maximized] (pg. 343, second column).

As per claim 9, Bethune teaches terminating the performing of the first laser gate dither [multiple delays and phases];

performing a second laser gate scan;

terminating the second laser gate scan; and

performing a second laser gate dither [second phase] (pg. 343).

As per claim 10, Bethune teaches terminating and repeating the first laser gate dither periodically so as to perform a series of laser gate dithers (pg. 343 and Fig 3a).

As per claim 11, Bethune teaches a computer-readable medium having instructions embodied therein to direct a computer in a quantum key distribution (QKD) system adapted to control the operation of the QKD system to perform the following method of auto-calibrating of a QKD system (Fig. 1), the method comprising:

sending photon signals between encoding stations in the QKD system, wherein the photon signals are generated by a laser in response to laser gating signals having associated arrival times T at the laser (pg. 340);

performing a first laser gate scan by varying the arrival time T over a first range of arrival times R1 to establish a first optimal arrival time TMAX corresponding to a first maximum number of photon counts NMAX from a detector unit in one of the QKD stations (Fig. 3a);

terminating the first laser gate scan when the first TMAX is established; and performing a first laser gate dither by altering the arrival time T over a second range [changes phase to maximize photon count] of arrival times R2 R1 about the first TMAX to maintain either a) the first maximum number of photon counts NMAX, or b) a different

maximum number of photon counts N'MAX over the second range R2 (Fig. 3a and pg. 343 second column – pg. 344 first column).

As per claim 12, Bethune teaches A method of auto-calibrating a quantum key distribution (QKD) system having a laser, a single-photon detector (SPD) unit and controller operably coupled to the laser and the SPD unit (pg. 340 and Fig. 1), comprising:

generating photon signals with the laser by activating the laser with laser gating signals sent from the controller, the laser gating signals having an associated laser gating signal timing T (Fig. 3a);

sending the photon signals between encoding stations in the QKD system (Fig. 1);

performing a first laser gate scan to determine an optimum arrival time TMAX [[of a]] for the laser gating signals sent from a controller to arrive at the laser

by obtaining a first optimum number of photon counts at the SPD unit (top part of Fig. 3a); terminating the first laser gate scan when TMAX is established (multiple delays tested); and periodically dithering the laser gating signal arrival time about TMAX to maintain either the first optimum number of photon counts or a second optimum number of photon counts (bottom part of Fig. 3a, phase differences and pg. 343 second column).

As per claim 13, Bethune teaches terminating the laser gating signal dithering; and performing a second another laser gate scan (Fig. 3a and pg. 343).

As per claim 14, Bethune teaches the first and/or second optimum number of photon counts is is/are a maximum number of photon counts (Fig. 3a).

As per claim 15, Bethune teaches A method of auto-calibrating a quantum key distribution (QKD) system having two encoding stations, and a laser coupled to a controller in one of the encoding stations (Fig. 1), the method comprising:

performing a laser gate scan to establish an optimum arrival time of a laser gating signal at the laser that corresponds to a first optimum number of photon counts from a single-photon detector (SPD) unit in one of the encoding stations when exchanging photon signals between the encoding stations (Fig. 3a);

terminating the laser gate scan [multiple delay tests] (Fig. 3a); and

performing a laser gate dither process by varying the arrival time of the laser gating signal around the optimal arrival time in order to provide minor adjustments to the arrival time that lead to the SPD unit yielding either the first optimum number of photon counts, or a second optimum number of photon counts (pg. 343-344).

As per claim 16, Bethune teaches the first and/or second optimum number of photon counts is either a maximum number of photon counts (Fig. 3a), or a maximum of a total number of photon counts for a given interval divided by a number of double-clicks in the same interval (Fig. 3b).

Conclusion

The following prior art has been found pertinent to the invention but has not been relied upon in the claim rejections.

USP 6,342,701, to Kash teaches A method of auto-calibrating a quantum key distribution (QKD) system having two encoding stations, a laser and a single-photon detector (SPD) unit (Fig. 2), comprising:
a) performing a laser gate scan by sending a laser gating signal to the laser and varying an arrival time T of the laser gating signal over a first select range R1 to determine an optimal arrival time TMAX that corresponds to an a first optimum number of photon counts from the SPD unit for photon signals generated by the laser and exchanged between the two encoding stations (Fig. 3).

USP 6,104,986 to Arevalo teaches a method directed to any algorithm whereby the phase can be shifted ever so slightly to achieve a gain in performance. Once a range is determined, that range can be further divided to test for the best value in the range because changing the phase yields different results (Fig. 4 and col. 5, lines 44-55).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL R. VAUGHAN whose telephone number is (571)270-7316. The examiner can normally be reached on Monday - Thursday, 7:30am - 5:00pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on 571-272-3795. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. R. V./

Examiner, Art Unit 2131

/Syed Zia/

Primary Examiner, Art Unit 2131